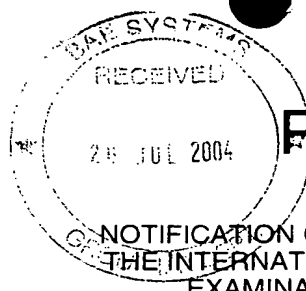


PATENT COOPERATION TREATY

AT

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY



PCT

To:

BAE SYSTEMS plc
GROUP IP DEPARTMENT
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GRANDE BRETAGNE

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 26.07.2004

Applicant's or agent's file reference
XA1531

IMPORTANT NOTIFICATION

International application No.
PCT/GB 03/01672

International filing date (day/month/year)
17.04.2003

Priority date (day/month/year)
22.04.2002

Applicant
BAE SYSTEMS PLC et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

Applicant's or agent's file reference XA1531	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB 03/01672	International filing date (day/month/year) 17.04.2003	Priority date (day/month/year) 22.04.2002
International Patent Classification (IPC) or both national classification and IPC G01S17/58		
Applicant BAE SYSTEMS PLC et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 11 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 5 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the opinion II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application 		
Date of submission of the demand 14.11.2003	Date of completion of this report 26.07.2004	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Hekmat, T Telephone No. +49 89 2399-7132	



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/01672

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1, 4-10 as originally filed
2-3 received on 01.07.2004 with letter of 01.07.2004

Claims, Numbers

1-13 received on 01.07.2004 with letter of 01.07.2004

Drawings, Sheets

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☒ the claims, Nos.: 14,15
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/01672

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:

- ☐ restricted the claims.
☒ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
☒ not complied with for the following reasons:

see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	6-12
	No: Claims	1-5,13
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/01672

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/01672

The following documents are referred to in this communication:

D1: GB-A-2 265 514 (MARCONI GEC LTD) 29 Sep. 1993 cited in the application

D2: US-A-6 034 760 (REES FRANK L) 7 March 2000

Point IV:

The present application is considered to lack unity, R. 13 PCT.

In particular, the following groups of inventions can be identified:

- Group 1: Claims 1-7 and 13,
a laser vibrometer having an array of coherent optical receivers for identifying remote targets by detecting mechanical vibrations, whereas the output signals of the receivers are combined **in a multiple input phase-locked loop**, in order to minimize the speckle effect,
- Group 2: Claims 1 and 8-13,
a laser vibrometer having an array of coherent optical receivers for identifying remote targets by detecting mechanical vibrations, whereas the output signals of the receivers are combined **in an autocovariance processor** in order to minimize the speckle effect.

Both invention groups are based on the independent claim 1 defining:

A laser vibrometer for identifying remote targets by detecting mechanical vibrations therein, the vibrometer having an array of coherent optical receivers for collecting a portion of laser light reflected by a remote target, each receiver providing a coherent output, and signal processor means for combining the coherent outputs of the receivers to produce a signal representative of the remote target and for removing laser speckle.

However, the combination of documents D1 and D2 renders all features of claim 1 obvious (see point V, below). Thus, the subject-matter of claim 1 is considered to lack inventive step.

Therefore, the dependent claims 2-12 (independent claim 13 is defining the

corresponding method of claim 1) unravel in the two above groups reflecting two different inventions, in which the dependent claims 2-7 define a **multiple input phase-locked loop** and dependent claims 8-12 define an **autocovariance processor**.

Whereas, in each case a completely different approach is used for combining signals in order to minimize the laser speckle (non-inventive feature of claim 1) and accordingly, the two invention groups do not comprise any common special technical features, R. 13.2 PCT. Consequently, the two groups of inventions are not so linked to form a single general inventive concept, as required by R. 13.1 PCT.

Point V:

1. The subject-matter of claims 1-5, and 13 is considered to lack inventive step, Art. 33(3) PCT.

- 1.1 Document D1 (Fig. 1), discloses the following features of independent claim 1:

A laser vibrometer for identifying remote targets by detecting mechanical vibrations therein (p. 1, par. 1-2), the vibrometer having an array of coherent optical receivers for collecting a portion of laser light reflected by a remote target (6; p. 3, last par. - p. 4, 1st par.), (each receiver providing a signal representative of the remote target).

Thus, the apparatus of claim 1 differs from the disclosure of document D1 in that

each receiver provides a **coherent** output, and the vibrometer further comprises **signal processor means for combining** said coherent outputs of the receivers to produce a signal representative of the remote target and for removing laser speckle.

These differing features lead to an improved vibrometer precision by means of reduced received noise. Therefore, the objective technical problem to be solved by these distinguishing feature is **to further increase the vibrometer precision by means of reducing the received noise**.

It is well-known in the field of laser vibrometry that laser speckle acts as a significant noise source. Therefore, the skilled person faced with the above stated problem would also search for this aspect and would turn to document D2 which

relates to a laser vibrometer for detecting weather conditions in the atmosphere. In order to overcome the above problem, D2 (fig. 3) discloses the following measures:

each receiver (of an array of coherent optical receivers: 89, 91, 92) provides a coherent output (94; col. 7, l. 14-19), and the vibrometer comprises signal processor means for combining (94, 96, 100 and phase-locked loop described in col. 4, l. 59-63) the coherent outputs of the receivers to produce a signal (102a) representative of the remote target and for removing laser speckle (col. 7, l. 24-47 and col. 8, l. 18-23).

The above signal processing steps can directly be applied to outputs of amplifiers 15 (fig. 1) of device disclosed in D1 (**first embodiment**) in order to obtain a speckle minimised signal representative of the target. Hence, the person skilled in the art would readily include without any inventive activity the features disclosed in documents D2 in the device described in document D1 and thus arrives at the subject-matter of claim 1.

- 1.2 Document D2 discloses the additional feature of dependent claim 2, as follows:

the signal processor comprise a phase-locked loop (col. 4, l. 59 - col. 5, l. 1) having multiple inputs (89), in which the signal derived from the multiple inputs (102a) is representative of the remote target (col. 5, l. 1-7), substantially unaffected by laser speckle (col. 6, l. 17-23).

- 1.3 Document D2 discloses the feature of dependent claim 3:

the phased -locked loop comprises the multiple signal multipliers (89), said multipliers multiplying the input signals (84) by a further signal (90).

The following remaining feature of claim is considered as an usual design measure:

the further signal is generated by voltage controlled oscillator.

Detecting the frequency by means of a phase-locked loop (PLL) is commonplace

in the field of signal processing, whereas a conventional PLL includes a voltage controlled oscillator (VCO). In the method of D2 the loop is closed at the optical element level (89, col. 5, l. 1-7), therefore in this case "the further signal" is an optical signal (90). D1 in contrast discloses a PLL in the electrical part of the receiver (p. 2, 2nd par., l. 9-14). The skilled person is aware of the fact that such a PLL comprises a VCO providing one of the multipliers input signals ("the further signal").

- 1.4 The following additional features of dependent claims 4 and 5 merely specify minor implementation details of usual design:

claim 4: the further signal comprises a sinusoidal or a square wave;

claim 5: the phase-locked loop further comprises multiple low pass filters, said filters having cut-off frequencies in the kilohertz region.

- 1.5 Since claim 13 defines the corresponding method of claim 1, it equally lacks inventive step.

2. In view to the available prior art cited in the International Search Report it appears that the subject-matter of claims 6-12 (the objection to lack of clarity to claims 6 and 12 notwithstanding, see section 3.1, below) is new and involves an inventive step in the sense of Art. 33(3) PCT.

- 2.1 The combination of the features of dependent claim 6 (invention group 1) (the objection to lack of clarity notwithstanding) is neither known from, nor rendered obvious by, the available prior art. In particular, claim 6 defines the following additional feature:

the phased -locked loop further comprises a summing amplifier which sums the signals generated by the multiple lowpass filters and outputs a signal to an integrator.

Summing the output signals of the lowpass filters includes the amplitude information of the received signals in the combined signal representative for the target. The incorporation of signal amplitudes into the combining process and

thereby weighting the contribution of the signal phases is one of the essential features of the invention, which is neither disclosed nor hinted at in D2. The method of D2 obtains the combined output signal representative for remote target by means of **averaging the phase rates** of receiver signals, thus without considering the signal amplitudes.

- 2.2 Since dependent claim 7 refer to claim 6, it equally fulfils the requirement of involving an inventive step, Art. 33(3) PCT.
- 2.3 The following additional feature of dependent claim 8 (invention group 2) is neither known from, nor rendered obvious by, the available prior art:

the signal processors comprise an autocovariance processor having multiple inputs, in which the signal derived from the multiple inputs is representative of the remote target, substantially unaffected by laser speckle.

The incorporation of an autocovariance processor in the combining process of the receiver signals is not disclosed in any of the cited documents. Moreover, the concept of applying autocovariance signals in speckle reduction leads to an approach completely different from the method disclosed in D2.

- 2.4 Since dependent claims 9-12 refer to claim 8, they equally fulfil the requirement of involving an inventive step, Art. 33(3) PCT.

3. Further remarks:

- 3.1 Claims 3, 6, and 12 are considered to lack clarity, Art. 6 PCT.

- 3.1.1 Dependent claim 3 defines the following additional feature:

the phase-locked loop comprises multiple signal multipliers, said multipliers **multiplying the input signals** by a further signal generated by a voltage controlled oscillator.

However, it is not apparent from the claim definition, where the input signals are originating from, whereby the claim definition is rendered unclear. Due to the description (p. 5, l. 25 - p. 6, l. 2), each input signal of the phased-locked loop is

provided by a corresponding receiver output, which is considered to be essential to the definition of the invention.

3.1.2 Dependent claim 6 defines the following additional feature:

the phase-locked loop further comprises a summing amplifier which sums the **signals generated by the multiple low pass filters** and outputs a signal to an integrator.

However, it is not apparent from the claim definition, where the input signals of the low pass filters are originating from. Accordingly, it is unclear which signals are generated by low pass filters, which leads to unclarity of the claim definition.

Additionally, since claim 5 is the single claim which defines "low pass filters", claim 6 should refer to this claim.

3.1.3 Dependent claim 12 contains the following passage::

"... **said summation causing** the signal due to the laser speckle to be greatly reduced and **a signal representative of** the mechanical vibration of **the remote target to be output by the summation means.**"

However, according to claim 8 the signal representative of the remote target is **derived from the multiple inputs of the autocovariance processor**. Since, claims 8-10 does not define a link between the autocovariance processor and any of in claims 9-10 defined components (including the summation means), above definition renders the subject-matter of claim 12 ambiguous and unclear.

Claim 12 further contains the following passage:

"...performing a summation on said pairs of signals, **said summation causing** the signal due to the laser speckle to be greatly reduced ..."

The above feature lacks support by the description. According to the description the **summation on autocovariance of the pairs of converted signals** leads to reduced laser speckle and not the mere summation of the pairs of unprocessed converted signals themselves (p.9, l. 3 - p. 10, l. 15).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/01672

- 3.2 Document D2 is not acknowledged in the description, R. 5.1(a)(ii) PCT.
- 3.3 The present application does not meet the requirements of Rule 6.3(b) PCT that the independent claims should be set out in the two-part form, with those features which in combination are part of the prior art being placed in the preamble.